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Many-Dimensional Modal Logics: Theory and Applications

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Many Dimensional Modal Logics

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Many Dimensional Modal Logics:

Multi-Dimensional Modal Logic Maarten Marx,Yde Venema,2012-12-06 Modal Logic is a branch of logic with applications in many related disciplines such as computer science philosophy linguistics and artificial intelligence Over the last twenty years in all of these neighbouring fields modal systems have been developed that we call multi dimensional Our definition of multi dimensionality in modal logic is a technical one we call a modal formalism multi dimensional if in its intended semantics the universe of a model consists of states that are tuples over some more basic set This book treats such multi dimensional modal logics in a uniform way linking their mathematical theory to the research tradition in algebraic logic We will define and discuss a number of systems in detail focusing on such aspects as expressiveness definability axiomatics decidability and interpolation Although the book will be mathematical in spirit we take care to give motivations from the disciplines mentioned earlier on Many-Dimensional Modal Logics: Theory and Applications A. Kurucz,F. Wolter,M. Zakharyaschev,Dov M. Gabbay,2003-10-21 Modal logics originally conceived in philosophy have recently found many applications in computer science artificial intelligence the foundations of mathematics linguistics and other disciplines Celebrated for their good computational behaviour modal logics are used as effective formalisms for talking about time space knowledge beliefs actions obligations provability etc However the nice computational properties can drastically change if we combine some of these formalisms into a many dimensional system say to reason about knowledge bases developing in time or moving objects To study the computational behaviour of many dimensional modal logics is the main aim of this book On the one hand it is concerned with providing a solid mathematical foundation for this discipline while on the other hand it shows that many seemingly different applied many dimensional systems e g multi agent systems description logics with epistemic temporal and dynamic operators spatio temporal logics etc fit in perfectly with this theoretical framework and so their computational behaviour can be analyzed using the developed machinery We start with concrete examples of applied one and many dimensional modal logics such as temporal epistemic dynamic description spatial logics and various combinations of these Then we develop a mathematical theory for handling a spectrum of abstract combinations of modal logics fusions and products of modal logics fragments of first order modal and temporal logics focusing on three major problems decidability axiomatizability and computational complexity Besides the standard methods of modal logic the technical toolkit includes the method of quasimodels mosaics tilings reductions to monadic second order logic algebraic logic techniques Finally we apply the developed machinery and obtained results to three case studies from the field of knowledge representation and reasoning temporal epistemic logics for reasoning about multi agent systems modalized description logics for dynamic ontologies and spatio temporal logics The genre of the book can be defined as a research monograph It brings the reader to the front line of current research in the field by showing both recent achievements and directions of future investigations in particular multiple open problems On the other hand well known results from modal and first order logic are

formulated without proofs and supplied with references to accessible sources The intended audience of this book is logicians as well as those researchers who use logic in computer science and artificial intelligence More specific application areas are e g knowledge representation and reasoning in particular terminological temporal and spatial reasoning or reasoning about agents And we also believe that researchers from certain other disciplines say temporal and spatial databases or geographical information systems will benefit from this book as well Key Features Integrated approach to modern modal and temporal logics and their applications in artificial intelligence and computer science Written by internationally leading researchers in the field of pure and applied logic Combines mathematical theory of modal logic and applications in artificial intelligence and computer science Numerous open problems for further research Well illustrated with pictures and tables

Many-dimensional Modal Logics Dov M. Gabbay,2003 Modal logics originally conceived in philosophy have recently found many applications in computer science artificial intelligence the foundations of mathematics linguistics and other disciplines Celebrated for their good computational behaviour modal logics are used as effective formalisms for talking about time space knowledge beliefs actions obligations provability etc However the nice computational properties can drastically change if we combine some of these formalisms into a many dimensional system say to reason about knowledge bases developing in time or moving objects To study the computational behaviour of many dimensional modal logics is the main aim of this book On the one hand it is concerned with providing a solid mathematical foundation for this discipline while on the other hand it shows that many seemingly different applied many dimensional systems e g multi agent systems description logics with epistemic temporal and dynamic operators spatio temporal logics etc fit in perfectly with this theoretical framework and so their computational behaviour can be analyzed using the developed machinery We start with concrete examples of applied one and many dimensional modal logics such as temporal epistemic dynamic description spatial logics and various combinations of these Then we develop a mathematical theory for handling a spectrum of abstract combinations of modal logics fusions and products of modal logics fragments of first order modal and temporal logics focusing on three major problems decidability axiomatizability and computational complexity Besides the standard methods of modal logic the technical toolkit includes the method of quasimodels mosaics tilings reductions to monadic second order logic algebraic logic techniques Finally we apply the developed machinery and obtained results to three case studies from the field of knowledge representation and reasoning temporal epistemic logics for reasoning about multi agent systems modalized description logics for dynamic ontologies and spatio temporal logics The genre of the book can be defined as a research monograph It brings the reader to the front line of current research in the field by showing both recent achievements and directions of future investigations in particular multiple open problems On the other hand well known results from modal and first order logic are formulated without proofs and supplied with references to accessible sources The intended audience of this book is logicians as well as those researchers who use logic in computer science and artificial intelligence More specific application areas are

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Many-dimensional Modal Logic Yde Venema,1991 Many-dimensional Modal Logic Yde Venema,1989 Modal Logic Nino B. Cocchiarella,Max A. Freund,2008-08-04 In this text a variety of modal logics at the sentential first order and second order levels are developed with clarity precision and philosophical insight All of the S1 S5 modal logics of Lewis and Langford among others are constructed A matrix or many valued semantics for sentential modal logic is formalized and an important result that no finite matrix can characterize any of the standard modal logics is proven Exercises some of which show independence results help to develop logical skills A separate sentential modal logic of logical necessity in logical atomism is also constructed and shown to be complete and decidable On the first order level of the logic of logical necessity the modal thesis of anti essentialism is valid and every de re sentence is provably equivalent to a de dicto sentence An elegant extension of the standard sentential modal logics into several first order modal logics is developed Both a first order modal logic for possibilism containing actualism as a proper part as well as a separate modal logic for actualism alone are constructed for a variety of modal systems Exercises on this level show the connections between modal laws and quantifier logic regarding generalization into or out of modal contexts and the conditions required for the necessity of identity and non identity Two types of second order modal logics one possibilist and the other actualist are developed based on a distinction between existence entailing concepts and concepts in general The result is a deeper second order analysis of possibilism and actualism as ontological frameworks Exercises regarding second order predicate quantifiers clarify the distinction between existence entailing concepts and concepts in general Modal Logic is ideally suited as a core text for graduate and undergraduate courses in modal logic and as supplementary reading in courses on mathematical logic formal ontology and artificial intelligence *Handbook of Modal Logic* Patrick Blackburn,Johan F.A.K. van Benthem,Frank Wolter,2006-11-03 The Handbook of Modal Logic contains 20 articles which collectively introduce contemporary modal logic survey current research and indicate the way in which the field is developing The articles survey the field from a wide variety of perspectives the underling theory is explored in depth modern computational approaches are treated and six major applications areas of modal logic in Mathematics Computer Science Artificial Intelligence Linguistics Game Theory and Philosophy are surveyed The book contains both well written expository articles suitable for beginners approaching the subject for the first time and advanced articles which will help those already familiar with the field to deepen their expertise

Please visit http people uleth ca woods RedSeriesPromo_WP PubSLPR html Compact modal logic reference Computational approaches fully discussed Contemporary applications of modal logic covered in depth Deontic Logic in Computer Science Ron van der Meyden,Leendert van der Torre,2008-07-14 This volume presents the papers contributed to EON 2008 the 9th Inter tional Conference on Deontic Logic in Computer Science held in Luxembourg July 16 18 2008 This biennial conference series is designed to promote int national cooperation amongst scholars who are interested in deontic logic and its use in computer science The scope of the conference is interdisciplinary and includes research that links the formal logical study of normative concepts and normative systems with computer science arti cial intelligence philosophy ganization theory and law The EON website http www deonticlogic org contains links to previous conferences and their papers This history reveals a vibrant interdisciplinary research program Papers for these conferences might address such general themes as the velopment of formal systems of deontic logic and related areas of logic such as logics of action and agency or the formal analysis of all sorts of normative concepts such as the notions of rule role regulation authority power rights responsibility etc or the formal representation of legal knowledge They might also be concerned with applications such as the formal speci cation of n mative multiagent systems the speci cation of systems for the management of bureaucratic processes in public or private administration or the speci cation of database integrity constraints or computer security protocols and more Of particular interest is the interaction between computer systems and their users *Cylindric-like Algebras and Algebraic Logic* Hajnal Andréka,Miklós Ferenczi,István Németi,2014-01-27 Algebraic logic is a subject in the interface between logic algebra and geometry it has strong connections with category theory and combinatorics Tarski s quest for finding structure in logic leads to cylindric like algebras as studied in this book they are among the main players in Tarskian algebraic logic Cylindric algebra theory can be viewed in many ways as an algebraic form of definability theory as a study of higher dimensional relations as an enrichment of Boolean Algebra theory or as logic in geometric form cylindric in the name refers to geometric aspects Cylindric like algebras have a wide range of applications in e g natural language theory data base theory stochastics and even in relativity theory The present volume consisting of 18 survey papers intends to give an overview of the main achievements and new research directions in the past 30 years since the publication of the Henkin Monk Tarski monographs It is dedicated to the memory of Leon Henkin Logics in Artificial Intelligence Sarah Gaggl,Maria Vanina Martinez,Magdalena Ortiz,2023-09-23 This book constitutes proceedings of the 18th European Conference on Logics in Artificial Intelligence JELIA 2023 held in Dresden Germany in September 2023 The 41 full papers and 11 short papers included in this volume were carefully reviewed and selected from 111 submissions The accepted papers span a number of areas within Logics in AI including argumentation belief revision reasoning about actions causality and change constraint satisfaction description logics and ontological reasoning non classical logics and logic programming answer set programming

The Enigmatic Realm of **Many Dimensional Modal Logics**: Unleashing the Language is Inner Magic

In a fast-paced digital era where connections and knowledge intertwine, the enigmatic realm of language reveals its inherent magic. Its capacity to stir emotions, ignite contemplation, and catalyze profound transformations is nothing in short supply of extraordinary. Within the captivating pages of **Many Dimensional Modal Logics** a literary masterpiece penned by way of a renowned author, readers embark on a transformative journey, unlocking the secrets and untapped potential embedded within each word. In this evaluation, we shall explore the book is core themes, assess its distinct writing style, and delve into its lasting impact on the hearts and minds of people who partake in its reading experience.

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